Title: Let's Open the Door to Patterns and Problem Solving

Brief Overview:

This unit is comprised of three lessons: Border Building, The Sorcerer's Apprentice, and Save the Rainforest. Each lesson is intended to be completed within one class period (50 to 60 minutes in length). The lessons are arranged developmentally and include suggestions for optional extension activities. Students will create patterns, make tables, and develop and justify their conclusions. The lessons make connections to science, social studies, music, and literature. Communication skills will be developed through math journal responses. Self-assessment forms will be completed in student pairs.

Links to Standards:

- **Mathematics as Problem Solving**
  Students will demonstrate their ability to solve problems in mathematics including problems with open-ended answers, problems which are solved in a cooperative atmosphere, and problems which are solved with the use of technology.

- **Mathematics as Communication**
  Students will demonstrate their ability to communicate mathematically. They will read, write, and discuss mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematics as Reasoning**
  Students will demonstrate their ability to connect mathematics with language and the signs, symbols, and terms of the discipline.

- **Mathematical Connections**
  Students will demonstrate their ability to connect mathematics topics within the discipline and with other disciplines.

- **Number Sense and Numeration**
  Students will demonstrate their ability to describe and apply number relationships using concrete and abstract materials as they create patterns and find relationships. Students will demonstrate their ability to solve problems using arithmetic operations, with technology where appropriate. They will determine reasonableness of solutions.

- **Whole Number Computation**
  Students will use calculators in appropriate computational situations. They will select and use computation techniques appropriate to specific problems and determine whether the results are reasonable.

- **Patterns and Relationships**
  Students will demonstrate their ability to recognize numeric and geometric relationships by describing, modeling, creating and classifying patterns. Students will generalize a relationship from the data they have collected.

Grade/Level:

Grades 3-5

Duration/Length:

Each of the lessons in this unit can be completed in one class period. Two additional class periods will be necessary to complete the performance assessment at the end of the unit. The optional writing rubric is for the teacher who wishes to score the performance assessment in terms of both math and language criteria.

Prerequisite Knowledge:

Students should have working knowledge of the following skills:

- performing basic calculator functions
- responding to a math journal

Objectives:

Students will:

- work cooperatively with partners.
- copy, continue and create patterns.
- organize and display data.
- use the constant arithmetic feature of a calculator to extend data (Lesson 2).
- justify and explain relationships.
- complete self-assessment tool (Student Resource 3a & 3b).
- reflect upon their learning.

Materials/Resources/Printed Materials:

- Pattern blocks or 1" square pieces of colored construction paper (Lesson 1)
- Student Resource 1 (Lesson 1)
- Overhead projector (Lessons 1 & 3)
- Crayons, markers, or colored pencils (Lessons 1 and 2)
- The Sorcerer's Apprentice book or video by Walt Disney Studio (Lesson 2)
- Blank newsprint (Lesson 2)

- Calculator (Lesson 2)
- Student Resource 2 (Lesson 3)
- Student Resource 3a & 3b "You and Me Assessment" for Lessons 1, 2 and 3
- Student Resource 4 (Writing to Inform Prompt)
- Teacher Resource 1
- Teacher Resource 2 (Letter Rubric)
- Student Math Journal (Lessons 1, 2, and 3)

Development/Procedures:

Lesson 1 - "Border Building"

- Display a "Math Talk" poster. This poster is used to record vocabulary introduced in the patterns lessons. The words "sequence, core, term, and pattern" should be introduced during this lesson (sequence = the entire series of terms; core = the repeating part of the pattern; term = a single unit of a pattern; pattern = something that repeats)

- Model a number of hand and finger movements such as CLAP CLAP SNAP and have students make the same movements.

- Pass out pattern blocks or paper squares and displays a pattern such as RED RED GREEN and have students build them. Develop the idea that RED RED GREEN can also be identified as AAB. Use classroom materials to make patterns (ex: PENCIL PENCIL PEN). Have students brainstorm other possibilities (ex: CAR CAR BIKE or GIRL GIRL BOY).

- Directions to the next patterning activity may be written on the board or overhead projector. See Teacher Resource 1. Patterns can be displayed in the classroom and cores defined. (For example: AABB, ABB, ABC, etc.)

- Direct students to describe their patterns in their math journals.

- Copy and cut "Assessing You and Me" forms and gives to students. These will be completed for their individual "I Grew With Patterns" assessment booklets.

  EXTENSION - Design a border on a sentence strip and compute the cost. Assign different prices for each tile color. Decide how to make a design that is both attractive and cost effective.

Lesson 2 - "The Sorcerer’s Apprentice”

- Show the segment of "The Sorcerer's Apprentice" (Walt Disney video "Fantasia") in which Mickey puts a spell on his broom to carry pails of water. It multiplies, and before long, the Sorcerer's pot overflows. If the video is unavailable, the book may be read.

- During the course of this lesson, add the following terms to the "Math Talk" chart: rule, function, data and table (data = bits of information, table = means of organizing data, function = a one-to-one relationship, a set of ordered pairs, rule = a statement that tells what to do).

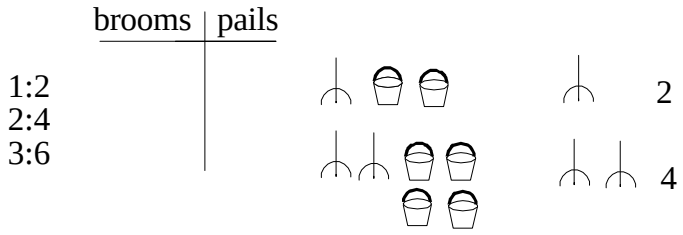
- Ask students, "If one broom carries two pails of water, how many pails will two brooms carry? What about 3 brooms? (Etc.) How many pails of water will 10 brooms carry?"

- Pass out calculators to students and show students how constant function can help extend their table of data.

- Direct students to organize their data and write a rule to show the relationship between brooms and pails. Students will use newsprint to organize their data.

- Direct students to use their journals to answer this question: “Is it possible to have an odd number of pails? Explain.”

- Display students' work to show their methods of organization. Teacher will look for students to make the connection to the function between brooms and pails. Students may or may not have used tables on their own. Some students may have drawings of random brooms and pails while others may be more organized. Teacher will discuss and model tables and their uses if necessary. Some examples of student work or teacher modeling may include:



rule = brooms × 2 = pails

- Students will work with a peer to complete the “Assessing You and Me” form. EXTENSION - Pretend you are Mickey. Write a paragraph and explain what you would do with all the brooms and pails.

Lesson 3 - "Save the Rainforest”

- Make a copy of Student Resource 2 available to students (either photocopy, chart paper, or overhead transparency). This provides an opportunity for students to read in the content area and follow a set of written directions.

- After students complete Student Resource 2, direct them to justify their rules in their math journals.

- Have students work with a peer to complete the "Assessing You and Me" form.

  EXTENSION - Have students design a bumper sticker to promote the preservation of tropical rainforests.

Performance Assessment:

Have students complete the writing to inform prompt on Student Resource 4. The scoring rubric is found on Teacher Resource 2.

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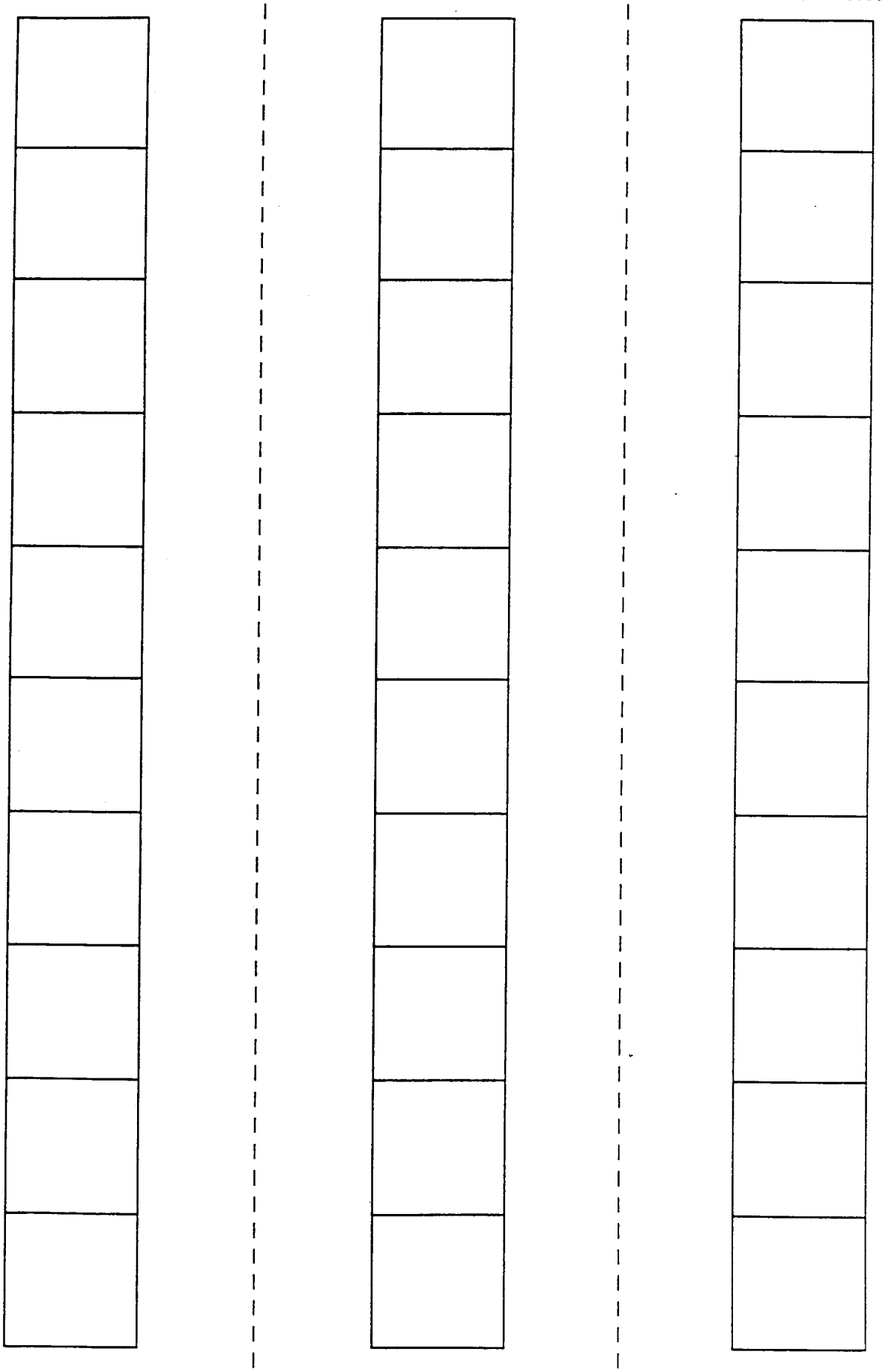

Save the Rainforests

Tropical rainforests make up only a small part of the earth's surface, but they have an important effect of global plants form clouds that are carried to cooler places. Rainforest plants also absorb carbon dioxide from the atmosphere. When these forest are cut down, the carbon dioxide accumulates in the atmosphere, trapping the earth's reflected heat. (This is known as the green house effect.)

In addition tropical rainforests produce items such as medicines, rubber, and food. It is estimated that 40% of the earth's tropical rainforests have been destroyed by such things as logging, road construction, mining, and slash and burn farming methods. According to some scientists, rainforests plants and animals are disappearing at a rate of 100 species per week. People all over the world are realizing that rainforests are fragile and nonrenewable resources.

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An imaginary rainforest with 4500 different species of plants and animals is being bulldozed bit by bit. Because of the clearing, 25 animal and plant species are being lost each month. How many species will be lost in 1 year? In 2 years? In 3 years? How many species will remain after 10 years? In how many years will the rainforest be gone?

Create a table to display your data. Find a rule that will enable you to compute the loss of species for any number of years.

Student Resource 3a

"ASSESSING YOU AND ME" Border Building Lesson

Score	Journal entry includes:
3	My writing uses words from the "Math Talk" chart to demonstrate that my pattern repeats. I remembered to include a picture of my pattern. I was able to explain my ideas clearly.
2	Includes 2 of the above.
1	Includes 1 of the above.
0	I was off the topic.

_____ _____

My Name Peer Name

My score _____ Peer score _____

My response could have been EVEN better if I had:

"ASSESSING YOU AND ME" The Sorcerer's Apprentice Lesson

Score	Journal entry includes:
3	My writing uses words from the "Math Talk" chart to explain my answer. I drew a table to organize my data. I used a number sentence or rule to explain my answer.
2	Includes 2 of the above.
1	Includes 1 of the above.
0	I was off the topic.

_____ _____

My Name Peer Name

My score _____ Peer score _____

My response could have been EVEN better if I had:

"ASSESSING YOU AND ME" Save the Rainforest Lesson

Score	Journal entry includes:
3	My writing uses words from the "Math Talk" chart. I drew a table or chart to organize my data. I generated a rule from my data.
2	Includes 2 of the above.
1	Includes 1 of the above.
0	I was off the topic.

_____ _____

My Name Peer Name

My score _____ Peer score _____

My response could have been EVEN better if I had:

I GREW WITH PATTERNS

ACTIVITY ASSESSMENT

_____

Name

_____

Date

WRITING TO INFORM PROMPT

Write me a letter about our study of patterns. Refer to your Math Journal responses for each lesson. Your letter should include the following information:

What you learned about patterns from each lesson.
Which lesson you enjoyed the most and explain why.

Remember you are writing as a mathematician and you will want to use appropriate vocabulary. You also want to be sure to follow the guidelines for writing a friendly letter.

DESIGN A SCHOOL HALLWAY BORDER!

The principal would like our class to design a decorative hallway border that could be used in the renovation of our school.

You need to create several patterns, each with a core containing two to four members. Continue the pattern until it fills the entire strip.

When you are finished, choose your favorite pattern, cut it on the dotted line, sign the back and give it to your teacher.

LETTER RUBRIC - MATH

3 Uses appropriate math vocabulary
Ideas are clearly stated
Conclusions are justified

2 Contains two of the above

1 An attempt is made but does not meet full criteria requirements

0 Too little response, off task

OPTIONAL LETTER RUBRIC - WRITING TO PERFORM

3 Has a topic sentence that addresses the main idea
Has a concluding sentence
Is well organized
Uses correct form

2 Contains three of the above

1 An attempt is made but does not meet full criteria requirements

0 Too little response, off topic

Resources/Ideas for Expanding Perceptions of Patterns

Two very helpful catalogues of resources including manipulatives, activity books and posters are:

Creative Publications Catalogue
5623 W. 115th St.
Alsip, IL 60803
Toll free tel. no. 1-800-624-0822
Fax no. 1-800-624-0821

Dale Seymour Publications
P.O. Box 5026
White Plains, NY 10602-5026
Toll free tel. no. 1-800-872-1100
Home page http://www.aw.com/dsp

In addition, the NCTM addenda series grade level books contain grade-appropriate patterning activities and patterning activity masters. There is also a grade 5-8 book entitled Patterns and Functions, which includes activities and games using manipulatives that are very engaging for students. These books are in both catalogues and can also be ordered from NCTM.

Beginning of the year bulletin board using the "Math in Nature" posters from Creative Publications:

- Cut "picture frames" from colored construction paper to cover all print on each poster, leaving only the picture showing.
- Title the board "WHAT DO THESE PICTURES HAVE IN COMMON?"
- Place a clipboard and pencil nearby for students to write their observations/predictions.
- After several days of discussion among students, ask leading questions....Beginning predictions are usually "They are all in nature." "They can be found outdoors."
- Direct students to be careful and specific and find a quality in common. Responses will narrow to "Nature."
- Remove frames and discuss how much math surrounds us.
- Brainstorm examples on the board or chart paper.
- Ask students to look for examples of patterns in their lives and bring them into class. Create a classroom display or bulletin board.
- Have students reflect in their math journal. Add examples as the year progresses.

Multiplication Table Review

Students can have fun learning, reviewing and internalizing multiplication tables by looking for patterns and coloring them. Make 11 copies of the 12 x 12 multiplication table as found in the Fourth Grade Book of the NCTM Addenda Series K-6. Have students color in the multiples of 2 on a table, the multiples of 3 on another table and so on. Display the tables in the room and discuss the patterns. For a more detailed explanation of the activity refer to the aforementioned book.

Multiplication Buzz Pattern

Have students stand in a circle and begin counting off. Choose a number between 1 and 12, and at each multiple of that number say "Buzz!" Students need to listen carefully for the multiples of the chosen number; if they miss, they sit down.